

What is claimed is:

1. A method for increasing the efficiency of a turbine engine by controlling blade tip clearances comprising the steps of:

operating a turbine engine under substantially steady state conditions, the turbine engine having at least a compressor section and a turbine section, the turbine section including a rotor with discs on which a plurality of blades are attached;

providing air exiting the compressor section at a compressor exit temperature; routing at least a portion of the air exiting the compressor section to the rotor and discs of the turbine section without substantially reducing the temperature of the air portion from the compressor exit temperature as it is presented to the rotor and discs,

whereby blade clearances, defined between the tips of the blades and the neighboring ring segments, are minimized due to the thermal expansion of the rotor and discs.

2. The method of claim 1 wherein the compressor exit temperature is about 450 degrees Celsius.

3. The method of claim 1 wherein substantially steady state conditions include base load operation of the turbine engine.

4. A method for increasing the efficiency of a turbine engine by controlling blade tip clearances comprising the steps of:

(a) operating a turbine engine, the turbine engine having at least a compressor section and a turbine section, the turbine section including a rotor with discs on which a plurality of blades are attached;

(b) providing air exiting the compressor section at a compressor exit temperature;

(c) when the turbine engine operates under substantially transient conditions, substantially exclusively routing at least a first portion of air exiting the

compressor section to a cooling path, wherein the first portion of air is cooled to a cooling temperature that is less than the compressor exit temperature;

(d) supplying the first portion of air substantially at the cooling temperature to the rotor and discs, wherein the cooling temperature is less than the temperature of the rotor and discs, whereby clearances between the tips of the blades and the neighboring stationary blade ring increase as a result of the contraction of the rotor and discs;

(e) when the turbine engine operates under substantially steady state conditions, substantially exclusively routing a second portion of the air exiting the compressor section to a bypass path, wherein the temperature of the second portion of air exiting the bypass path is substantially unchanged from the compressor exit temperature; and

(f) supplying the second portion of air to the rotor and discs, wherein the temperature of the second portion of air is greater than the cooling temperature, whereby a clearance between the tips of the blades and the neighboring stationary blade ring decreases as a result of the thermal expansion of the rotor and discs in response to being exposed to the relatively higher temperature of the second portion of air.

5. The method of claim 4 further including the step of repeating steps (b)-(f) as necessary during engine operation, whereby adequate blade tip clearances are maintained.

6. The method of claim 4 wherein the cooling path includes at least one heat exchanger.

7. The method of claim 4 wherein the cooling temperature is about 150 degrees Celsius.

8. The method of claim 4 wherein the compressor exit temperature is about 450 degrees Celsius.

1 9. The method of claim 4 wherein substantially steady state conditions include
2 base load operation of the turbine engine.

1 10. The method of claim 4 wherein substantially transient conditions include part
2 load operation of the turbine engine.

1 11. The method of claim 4 wherein substantially transient conditions include
2 engine start up of the turbine engine.

1 12. The method of claim 4 wherein the first and second portions of compressor
2 exit air are substantially exclusively routed to one of the cooling path or the bypass
3 path by a valve.

1 13. A turbine engine assembly comprising:
2 a turbine engine having at least a compressor section and a turbine section,
3 the turbine section including a rotor with discs on which a plurality of blades are
4 attached;
5 a compressor exit air treatment circuit receiving at least portion of air exiting
6 the compressor section and routing the at least portions of air to the turbine section
7 for presentation to at least the rotor and discs, the compressor exit air treatment
8 circuit including a valve, a bypass path and a cooling path, the valve being
9 selectively operable between a first position, wherein at least a first portion of
10 compressor exit air at a compressor exit temperature is routed substantially
11 exclusively to the bypass path, and a second position, wherein at least a second
12 portion of compressor exit air at the compressor exit temperature is routed
13 substantially exclusively to the cooling path; and
14 the cooling path including at least one heat exchanger, wherein the
15 temperature of the second portion of compressor exit air is cooled to a cooling
16 temperature substantially less than the compressor exit temperature after passing
17 through the cooling path and wherein the temperature of the first portion of
18 compressor exit air is substantially unchanged from the compressor exit temperature
19 through the bypass path.

1 14. The turbine engine assembly of claim 13 wherein the valve is selectively
2 positioned in the first position when the turbine is operating substantially at base
3 load.

1 15. The turbine engine assembly of claim 13 wherein the valve is selectively
2 positioned in the second position when the turbine is operating under one of part
3 load or engine startup conditions.

1 16. The turbine engine assembly of claim 13 wherein the cooling temperature is
2 about 150 degrees Celsius.

1 17. The turbine engine assembly of claim 13 wherein the compressor exit
2 temperature is about 450 degrees Celsius.